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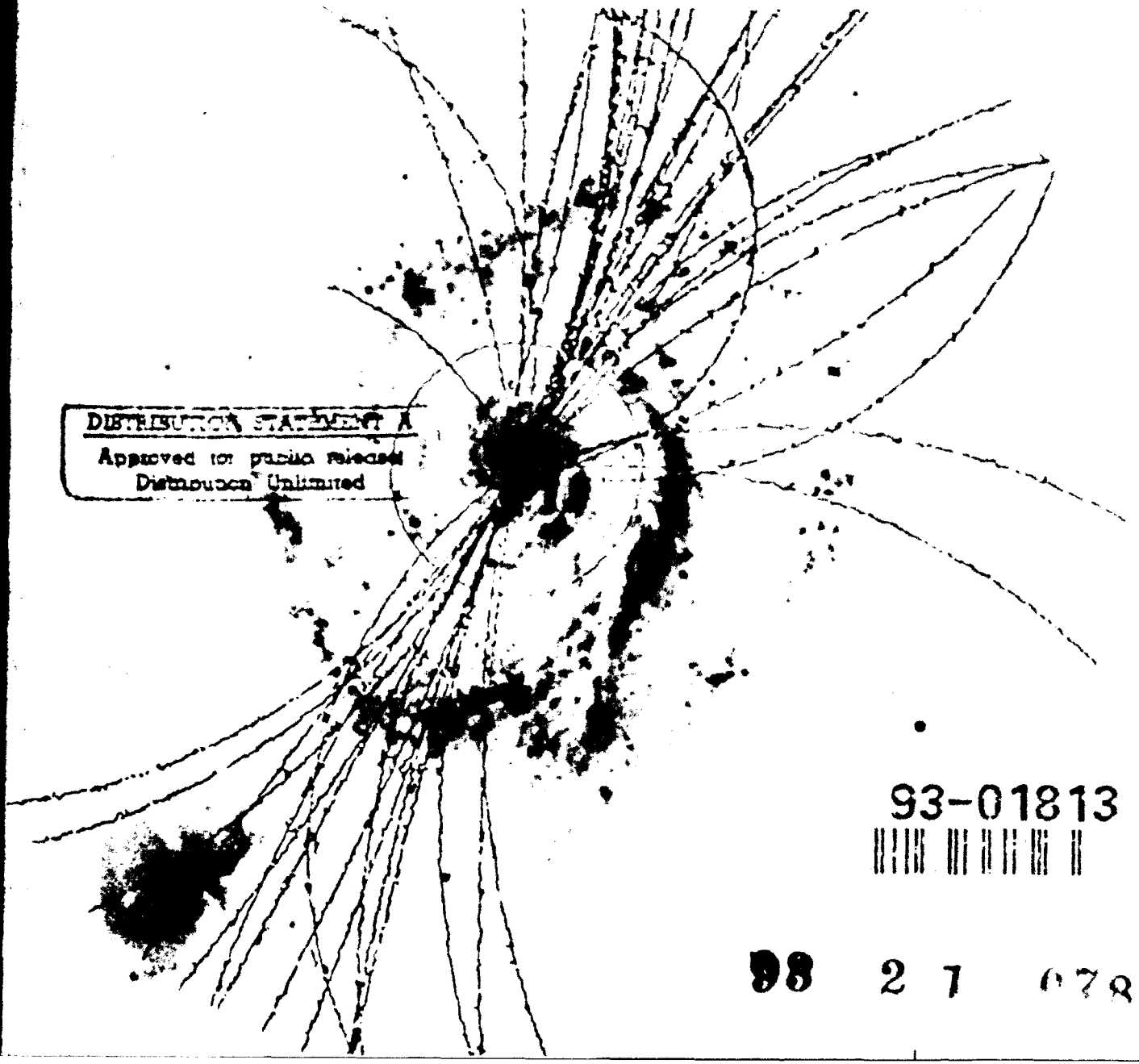
PARTICLE ASTROPHYSICS

NSF SCIENCE & TECHNOLOGY CENTER

The Changing Culture in Science— Bringing It into Balance

June 21 – 23, 1992
Berkeley, California

Conference Report and Call to Action



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The Changing Culture in Science— Bringing It into Balance

A national conference hosted by
The Center for Particle Astrophysics
June 21-23, 1992 — University of California, Berkeley

Summary

Premise: There is a need for change in the scientific culture to accommodate a new population. The need for change is compounded by the fact that science itself has and is changing rapidly. We are faced with the challenge to lead the change, to create a new model of science based on the potential that diversity offers for greater creativity and greater sensitivity to societal needs.

Purposes of the Conference

Exploring and developing strategies to improve the culture in science and the quality of scientific endeavor

Identifying factors that discourage interest and participation in science

Improving communication by establishing a new model for interaction between scientists

Exploring ways to initiate positive change in diverse environments

Process of Conference Development

Identifying relevant issues from the experience of members of the Science and Technology Centers

Designing a plan which would enable representatives from all levels to communicate openly about the issues, free of hierarchical restrictions

Setting guidelines for the working group discussions by adopting principles that foster inclusivity and creative thinking

Structure of the Conference

Speakers with a variety of perspectives discussed the scientific culture and articulated their vision of change.

Representatives from different cultures presented traditional and modern creation stories to bring into focus the conference theme of commonality.

Working group members shared experiences and expertise while collaborating on strategies and recommendations.

Senior members of the scientific community formed an Integration Team. They responded to the findings of the working groups and explored strategies for insuring the continuity of the work of the conference.

Participants

106 people, including public school science teachers, junior and senior university faculty, industrial researchers, science institution staff, undergraduate and graduate students, administrators and senior scientists. Participants included members of underrepresented minority groups and a balanced number of female and male scientists.

Issues Addressed

How to build an inclusive, diverse scientific community without compromising scientific excellence

How to increase interest, understanding and accessibility of science in order to broaden the base of participation

How the scientific culture can affirm that child raising, elder care, mentoring and teaching are valued and respected activities for scientists

How to provide equity for women and underrepresented minorities at all levels, including faculty and administrative positions

How to welcome and provide support for entering members of the community

Conclusions

Diversity and excellence are not intrinsically opposed. To the contrary, diversity can be conducive to a more creative science and better linkages to society, and should be valued.

The frenetic competition and over-specialization endemic to academia contribute to an often harsh environment that is poorly connected to the broader society. Science institutions have not adapted to accommodate changes in demographics and family structure.

The culture in science reflects the wider culture and affects all members of the science community.

Improving the climate in scientific institutions will encourage more participation by women and underrepresented minorities. Strategies for improving the culture in science are prerequisite to providing equity.

We need to continue to develop and disseminate methods of teaching which serve a culturally diverse population, and develop better processes for recruitment and retention.

The key to change rests with the individual.

Change requires the active involvement of all members of the community, including strong support from the top.

Next Steps

Dissemination of the processes employed to develop the conference

Initiation of these processes at home institutions

Dissemination of the conference proceedings as a handbook for change

Creation of a computer teleconferencing network to maintain the charge of the working groups

A second conference to evaluate and extend the process of change

What is Needed

Accepting that we are accountable for our surrounding culture

Wider communication about the culture of science and the process for change in academic departments and research institutions

Training in alliance-building techniques

Recognizing that these are evolving issues requiring ongoing attention

Funding and support for individuals and programs to carry through these initiatives

Conference Sponsors

The Center for Astrophysical Research in Antarctica
Yerkes Observatory, University of Chicago

The Center for Molecular Biotechnology
California Institute of Technology

The Center for Particle Astrophysics
University of California, Berkeley

The Center for Research on Parallel Computation
Rice University

The Center for Quantized Electronic Structures (QUEST)
University of California, Santa Barbara

Defense Advanced Research Project Agency (DARPA)

Lawrence Berkeley Laboratory

The National Science Foundation

United States Office of Naval Research

University of California, Berkeley

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Leon Lederman, *Fermi Institute, University of Chicago*

Arvol Looking Horse (translated by Carol Ann Heart) *Lakota Sioux Nation*

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Shirley McBay, *Quality Education for Minorities Network*

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Part I:

The Need for Change

I've been to a number of conferences in my career on how to increase participation in science and engineering. Most start with the thesis that we need to figure out how to get more underrepresented groups into the system, as if the system itself were some pre-existing entity ordained by God. This conference is saying, let's look at it in a broader way. . . let's look at what the system is and how it needs to change and adapt to who the people are.

Walter Massey, Director, National Science Foundation

Living in the Culture

A young Taiwanese graduate student is taunted daily by the professor he assists as a teaching fellow. "Hey, Chinaman," the professor calls out to him during class. The professor blames him when undergraduates break the lab equipment. One day, there is a problem in the laboratory. The professor orders his TA to climb a ladder to make an adjustment. On his way down, the student slips and grabs a pipe to support himself. The pipe carries steam and is probably between 300 and 400 degrees Fahrenheit. It instantly burns the skin off the student's hand. Nearly fainting, he shoves his hand inside his pocket and says nothing, waiting another twenty minutes for class to end before rushing off to the health center. The raw, burned hand is more bearable than having his psyche flayed once more by the professor.

A young African-American man, a first-year graduate student at Stanford, articulates a metaphor. Scientific culture is like particle physics: In the middle of the system is the nucleus of senior scientists and top administrators. They constitute less than one percent of the volume, but they carry most of the weight. Orbiting the protons, doing the work, are the electrons of scientific culture, the graduate students and postdocs. But that's not quite all. There are known to be massless or nearly massless particles, called neutrinos, which can pass through miles of matter without ever interacting. They zip through our bodies, through the Earth, through the solar system, not even slightly disturbing the protons and electrons. "I," says the young black man, "am a neutrino." He is not sure whether he is a neutrino because he did his undergraduate work at Tugaloo College, while the rest of his classmates come from places like Harvard and MIT, or because of his race. "I'll never know," he says.

A young graduate student in mathematics feels her labels precede her. "I have one goal in life. That goal is to be an excellent

mathematician. But, in the eyes of everybody, I'm a woman. I'm Mexican-American." The question that she reads in everyone's eyes is, "How good a mathematician is she? How did she get here?"

A young graduate student in physics who had planned to major in chemistry switched fields when a physics professor took the trouble to tell her that she was talented. "I found out later that the chemistry department was really sorry that I'd left, but they didn't say it at the time." She did well as an undergraduate and a graduate student, but then began to be aware "that there was a conspicuous absence of women other than students among the physicists. This started me wondering whether my goal of being a university professor was realistic. What became of the women graduate students?"

An MIT undergraduate who is a Native American reports that she no longer feels she can "relax and let down her defenses when all the people of color come together. I realized that minorities tend to treat other minority groups the way they have been treated."

A Rice University mathematics professor sponsors a program for minority students from colleges around the country in which they spend the summer working with a Rice professor.

This year, three out of the seventeen juniors and seniors majoring in science and engineering report that the most advanced mathematics class they have had is trigonometry. "They do not even know that they will not be competitive when it comes to going to graduate school or entering the work force."

These are a few of the windows into the lives of aspiring scientists that were opened by participants at the Berkeley conference. There were many more stories, told formally or informally, of wrestling with the existing culture of science. People spoke of the compromises and sacrifices they had made for science, and of those they could not make without ceasing to become themselves. They spoke of the strength they had forged within, and of the strength they had found in the support of others. The pivotal moments in their lives are also pivotal moments for science and for society.

Their experiences, and the experiences of the conference coordinators at their Science and Technology Centers, shaped the issues that the conference addressed. Working groups, each comprising as wide a range of participants as possible, including conference speakers, remained consistent throughout the meeting so that everyone would hear new perspectives and opinions.

The Changing Culture in Science Conference

Talking to and listening to the minority students made me realize for the first time what difficulties they had already surmounted just to get to their present situation. These exceptional people demonstrate all kinds of admirable traits that the nation needs I saw for the first time that we should broaden our approach to science education to make it possible for people to learn from us. . . . We should not just be teaching clones of ourselves.

Sandra Faber, Department of Astrophysics, University of California, Santa Cruz

Over 100 members of the scientific community exchanged views and worked to reach consensus on their group recommendations about the following topics:

How to build an inclusive, diverse scientific community without compromising scientific excellence.

How the scientific culture can affirm that child raising, elder care, and mentoring of students and colleagues are valued and respected activities.

How to address the underrepresentation of women and minorities in administrative and management positions in the scientific community.

How to make the first year in the scientific community more supportive and welcoming to people from all backgrounds.

How to increase interest in and understanding of science among the general population and among all students.

The issues that concern your community may be similar or different, but the goal will be the same: strengthening the relationships of each member of the scientific community to each other, to their families, and to society. The eventual outcome will be an environment more conducive to good science, and a scientific community that is a stronger, more vital model for and tributary to society.

A note of caution:

People who have left science because the culture did not offer sufficient support did not have a voice at this conference, and may not be represented at your discussions. All the conference participants, despite some cases of profound pain, appeared to be succeeding. The Taiwanese graduate student is now the Chancellor of the University of California, Berkeley. Some might take this as support for the position that nothing needs changing. The way may be hard, goes this argument, but it weeds out all but the very brightest and the most persevering, the only kind of people who belong in science. This view is more than blind; it is indefensible. A powerful intellect may turn away

from an environment that does not treat individuals on their merit, regardless of racial or economic or religious background, regardless of gender. A creative mind may be deadened by the tacit view that family life is, at best, irrelevant. No one can say what might have been discovered or understood by now if the culture in science were different.

These windows on contemporary life in science institutions, the expressed concerns and proposed strategies for change were all the result of the conference—*The Changing Culture in Science—Bringing It into Balance*, held June 21–23, 1992, in Berkeley, California. A broad spectrum of people dedicated to science assembled to explore attitudes, practices and policies long woven into the fabric of our working culture of science. This discussion confronted three fears: the fear that many people who want to become scientists are being thwarted by the scientific community's current expectations of which paths must be followed and which choices must be made as they progress; the fear that the scientific community is not interacting with the rest of society in a positive way; and the fear that the scientific community cannot accommodate people who do not fit the traditional picture of a scientist without lowering the quality of science.

Undergraduates, graduate students, postdocs, senior scientists and administrators—all from the country's forefront scientific institutions—together identified aspects of the current scientific culture in which these fears are rooted. Personal experiences, both encouraging and painful, were eloquently recounted. Presentations on bringing about change in other communities sparked new awareness. Possibilities began to take shape.

The next step was to forge strategies for changing the culture of science to better nurture all members of the community, without compromising the standards of good science.

This conference reinforced what we have discovered in our own institutions—National Science Foundation Science and Technology Centers founded to foster the exchange of ideas across disciplines—the heady results of bringing together talented people who traditionally would not have interacted.

We believe that this conference, and the ideas that flow from it, represent an equally exciting synergy. The conference confirmed that whatever we are now, we can be better: we can each tap into the imagination, the dedication, and the intellectual capabilities upon which we draw to do our science and use them to make our scientific community richer, more stimulating, more enjoyable.

The Conference Process

Interaction between participants with different backgrounds and perspectives required careful planning.

Conference organizers collaborated with consultants from the Berkeley-based group, *New Paradigms for Learning*, in designing a

sequence of activities to encourage an honest exchange of experiences and opinions. At preconference training sessions they taught facilitators, drawn from the scientific community, how to monitor discussion to maintain an atmosphere of mutual respect and open communication. This was supported by a set of guiding principles for communication which were developed at the Center for Particle Astrophysics as part of an experimental program (*In Balance*) which is devoted to building a diverse community. A copy of the guiding principles was included in each participant's registration packet and is included here, in appendices II & III.

The initial sessions set a multicultural context when representatives from the African, Hebrew, Hindu, Lakota Sioux and Mayan cultures told their creation stories. These culminated with the story from modern cosmology, the Big Bang. All of these accounts set the tone of shared experience and commonality for the participants and helped to establish a collegial and collaborative atmosphere in which the participants were free to focus on clarifying issues and defining viable strategies.

This handbook presents some of the ideas for bringing about change that emerged from the conference. Staff, students and professors, department chairs and division leaders, university presidents and chief executive officers—we can all take part in bringing out the best in our colleagues and ourselves. We want to thank our sponsors for making this event possible. We hope you will seize this opportunity, rejoice in it, and help to make this experiment a success.

PART II

Strategies for Change

Build a Working Relationship

The organizers of the Berkeley conference created a collaborative atmosphere in which each person felt of equal worth by taking steps to

Remove hierarchical cues (all participants wore name tags listing only their names and affiliations—no titles appeared).

Offer equal involvement in decision making to all group members.

Foster interconnectedness among different members of each group.

Respect differing opinions and avoid adversarial framing of the issues

Differences in interests, perceptions, and values vary among individuals and affect the way people interact. However, these differences need not be barriers to understanding and change. The success of an interchange is significantly determined by the extent to which participants in a discussion feel free to express themselves candidly, feel listened to, and sense an atmosphere that is collaborative rather than hostile or competitive.

If I start treating you as a worthy individual, equally entitled to your opinions, I am likely to learn that there are areas where your knowledge and skills are superior to mine and that some of your opinions are clearly worthy of respect. If I try to understand how you see things, I am almost certain to learn that my perceptions are more subject to bias than I had previously thought. If I behave as if I were more reliable, I am likely to become more conscious of my commitments and more committed to them. If I listen more actively and behave as if I were open to persuasion, I may find, to my surprise, that I am persuaded more often than I would have expected. If I treat you as someone who matters, you will begin to matter to me.

Getting Together, p.167

Bringing the scientific culture into better balance is a process, not an event. The best results will be achieved only when all the people involved feel that their concerns have been voiced, listened to, and respected. In addressing substantive issues, you will be

dealing with people you already know and with people you will meet again: peers, supervisors, administrative and secretarial staff, your students or your professors or your employees. The outcome of your work depends not only upon your commitment and your negotiating skills, but also upon the kind of relationship you have with the others involved. So, it makes sense to build good working relationships—in which the process of working together is rationally based, understanding, communicative, reliable and constructive—with the same care you devote to matters of substance.

Some general principles for nurturing relationships that are able to address differences successfully include these, drawn from *Getting To Yes* and *Getting Together* (see bibliography):

Frame each issue as a collaborative search for a better approach. Separate the people from the problem. Try to see yourselves as working side by side, attacking the problem, not each other.

Work to satisfy people's underlying interests, rather than specific positions they bring to the discussion. This means learning how others see things, even if you don't agree with them.

Express a desire to understand better how they came to be who and where they are. Check your assumptions about their concerns and motivations—and be open to surprises. Recognize the legitimacy of other points of view. Keep a sharp eye out for shared or dovetailing interests.

Before trying to agree on a solution, invent options that offer gains for everyone. Be creative; don't assume there is only one right answer. The better every concern is addressed, the more likely everyone is to be happy with the agreement and to work to live up to it.

Change your Environment

What can you do to help create a culture better suited to a more diverse group of people, and therefore a richer, more stimulating, more creative one—a culture in which the best science can flourish as never before?

The following suggestions grew out of the *Changing Culture in Science* conference. There are two important things to remember about them.

First, what they are: only a beginning. As you observe and reflect and discuss, you will find other ways to help the scientific culture shed its destructive biases about what a scientist is and how a scientist behaves.

Second, what they are not: answers to the question, "How do we get more people from underrepresented groups into the system?" The premise here is that scientific culture is not a pre-ordained, immutable system, but a living organism made up of interdependent individuals whose attitudes and values shape institutions, styles of teaching and learning, approaches to solving problems. It is changeable. And every individual in the culture is a trustee.

This meeting could prove to be a watershed event in how we begin to address the issue of broadening the base of science.

Walter Massey, Director, National Science Foundation

Two speakers, **Beverly Holmes**, from the U. S. Forest Service, and **Shirley McBay**, from the Quality Education for Minorities (QEM) Network, spoke about their participation in the change process: Holmes in a federal agency, and McBay in an educational institution with a strong research record. They both emphasized the need to collect information about existing strengths and weaknesses and to involve as many members as possible in recognizing concerns and generating new ideas. They stressed the importance of monitoring and publicizing the results.

Personal Support for Change

If we were to develop successful programs that attracted people to science, what would happen once they arrived and found a culture that they experienced as unwelcoming, aggressive, with limited opportunities for advancement and a lack of support for family life?

Rose Sergeant, Center for Particle Astrophysics

While the organizational support described above will provide more openings for individual contributions, every staff member, student, faculty or administrator in a scientific community can take the initiative:

Reach out. Seek allies, not only among people of similar backgrounds or circumstances. Give others sufficient information and opportunity to be empathetic.

Assume a need to learn more. Although you have the best intentions and can honestly evaluate your environment as healthy, there may be issues to which you are not yet sensitive. Be open to persuasion.

Avoid factionalism. Frame the issues in terms of making the whole culture better, rather than improving conditions for one identifiable group.

Recognize the interests and concerns of everyone in your group as legitimate, and help create the sense that all members have both the opportunity and the responsibility to make their points of view understood.

Take responsibility for seeing that concerns about the culture of science are discussed, formally and informally.

Take responsibility for initiating constructive discussions when you have an ambivalent or negative response to or from the culture of your science or institution,.

Welcome and take an interest in new members of your scientific community.

Strategies for Leaders

There is no doubt that change is inevitable. The question that we have to ask ourselves is: are we just passively enduring the change, or are we leading the change?

Bernard Sadoulet, Center for Particle Astrophysics

Establish a clear, visible process that fosters a candid exchange of views in order to assess the climate in your community or institution. Acting before there is a crisis may prevent or mitigate one.

Involve all employees in assessing the current climate and inventing strategies for improving it. Include recruiters and admissions staff.

Document and distribute widely evidence of problems within your community or institution.

Articulate your vision of the changes that you believe will benefit everyone in your field or institution.

"Walk the talk" (personally). Show by personal example that you consider improving the culture of science a high priority. Make it clear that you want your contributions to bringing about a better balance to be criteria by which your own performance is measured.

"Walk the talk" (institutionally). The way an organization allocates its resources clearly states its priorities. So do the factors that are explicitly weighed in such key personnel decisions as reappointment, promotion, tenure, and salary increases.

Talk with other leaders. Find out what changes have been made at other places and what the results have been. You may learn something valuable from others' mistakes—and from their successes.

Incorporate funding for education and mentoring of underrepresented groups into existing academic/research programs, rather than setting up peripheral organizations for this purpose.

Set explicit goals and accountability for senior personnel. For example, if the responsibility to teach well is to be taken seriously, it must count significantly toward advancement.

Hold open discussions on what constitutes good teaching/advising. Encourage departments/divisions to develop effective techniques for evaluating teaching/advising.

Use regular surveys and exit interviews to gain a better picture of which issues are being satisfactorily addressed and which are cause for concern.

Make a concerted effort to increase the number of members of underrepresented groups holding positions of power. Identify and counsel potential leaders.

Make explicit the steps in the process of promotion that may now be implicit.

Establish the principle that having a family is not a handicap to advancement and career satisfaction.

Promote understanding of personal priorities. Encourage communication and negotiation when personal and professional commitments threaten to conflict, e.g., create the possibility of flexible timetables for tenure decisions involving faculty members with family commitments.

Provide on-site day care at your institution for the children of faculty, students, and staff. Extend it to the children of visitors who participate in workshops and conferences.

Organize social occasions that include all members of the family.

Don't impose rigid quotas—but do reward departments that succeed in creating a more balanced environment.

Provide opportunities for pre-college teachers to participate in research.

Increase support fellowships for scientists returning to the field after spending time away (e.g., to raise families) and for people who wish to transfer to a new field or subfield.

Host public lectures and forums on topical scientific issues.

Inform the local public about the science your own institution is pursuing.

Hire, from within your ranks if possible, an expert in communication and education to help coordinate change.

Let everyone in your organization know what they can do to help bring the culture into better balance, both within your institution and in the larger social context.

Strategies for People Making Admissions and Hiring Decisions

No first world country can maintain its economic or technological strength with such a large percentage of its population outside of all science and mathematics activity.

Richard Tapia, Department of Computational and Applied Mathematics, Rice University

Explore potential as well as reviewing accomplishments. Establish apprenticeship programs.

Make a concerted effort to increase the number of underrepresented groups in leadership positions by identifying and training potential leaders. Make explicit the implicit expectations about what it takes to become a leader.

Don't penalize time spent raising a family.

Monitor performance and give feedback.

Include the judgment of people with similar life experiences in reviews.

Enlist the help of others as advisors to and advocates for newer people.

Focus on retention. Help establish formal/informal support groups and access to resources and counseling.

Strategies for Departmental Chairs and Faculty

Science as an enterprise is a lot bigger than just academia, but nevertheless, in order to get things done, I think it's appropriate to create a focus just so that people can concentrate their efforts... We all pass through academia and what happens there plays a very strong role in shaping our cultural expectations as scientists.

Sandra Faber, Department of Astrophysics, University of California, Santa Cruz

Make salary and tenure decisions based on the quality of work, e.g., require each tenure candidate to submit a fixed number of papers to the committee and weigh their *significance*, rather than the *number* of papers a candidate has produced.

Ensure that faculty and students from underrepresented groups participate on graduate admission committees, faculty hiring committees, and other key committees.

Reward time devoted to helping make the department better, e.g., reduce teaching load for professors whose sensitivities and experience make them especially important on hiring and admissions committees, or who want to develop a new course.

Help the department members to communicate better with each other. Promote access to workshops on communication, teaching, advising.

Use regular surveys and exit interviews to identify issues of concern among all members of the department. Invite formal presentations of concerns at a department meeting where attendance is mandatory.

Encourage informal communication in a nonhierarchical setting, e.g., establish a daily or weekly tea for the entire department or group, including graduate students, postdocs, staff and faculty.

Establish access to research activities as early in the undergraduate program as feasible to expose students to the joys (and frustrations) of *actually doing science as opposed to studying* science.

Openly discuss what constitutes good teaching and advising to establish criteria for evaluating members of the department.

Make it clear that the standards of acceptable teaching are high. Establish rewards for excellence in teaching. Promote pride in teaching, especially the introductory classes. Establish peer review of teaching as part of promotion decisions.

Promote opportunities for improving teaching skills. Help your institution organize a short course for graduate students and new members of the faculty.

Help to ease students' transition between taking classes and doing original research. Sponsor an annual faculty forum on the roles of advisors and the purpose of a thesis.

Establish opportunities for faculty members to welcome entering students personally. Let your students know that you care about and take pride in them before they graduate or leave.

Recruit graduate students from a broader, less traditional range of schools.

Make sure new students learn that critical evaluations of one's research are vital to science, and that probing the assumptions, design, construction, and interpretation of someone else's experiment or result is not a personal attack but an essential element of good science.

Set up graduate fellowships with provisions for family leave for both women and men.

Organize social activities that include family members.

Be as open to hiring the spouse of someone who is being hired elsewhere in the institution as to hiring anyone else.

Encourage members of your department to convey their excitement about their work to the community, and reward those who do. Consider rotating appointments of scientists who are available to give talks in schools, answer questions from the outside community, give public lectures.

Reflections from the Integration Team

The integration team responded to the working group reports by stressing specific priorities and discussing the feasibility of making changes. Here are summaries of their remarks. The material has been extensively edited but is faithful to what was said.

Bernard Sadoulet

"Three themes were repeated many times during the conference: The first theme was 'the passion that stands for science;' 'I want to be an excellent mathematician;' 'I want to be the best physicist.' And we passionately believe we should preserve the excellence of our science institutions.

"The second theme was 'nurturing,'—building an inclusive and supportive community. And the third theme was 'outreach,' outreach to society. Sharing our enthusiasm and sharing what makes our lives, but also trying to be sensitive to what society is, and what its problems are, and being responsible for the implications for society of what we do in science.

"There are questions that are not very clear to me. One is 'How do we build a balanced community of scientists?' We cannot all be at the top of the research ladder and we have to promote a view of science which values everyone in the enterprise. The second question, for which I have no answer, is, 'Where are the male minority people?' This absence reflects our inability in the academy to attract minority men to science. We need to understand their points of view if we wish to encourage diversity in science.

"And the third question is, 'How can we find time to address these issues?' The answer may be to share the load among ourselves and to attract three kinds of resources: money, time, and new people."

Sandra Faber

"Everybody is already very overworked and most of the suggestions that were put forward today, really, if you just took them at face value, would require us to get even less sleep at night than we currently do and, at the same time, one of our major foci is that we're supposed to be spending more time on our family and personal lives. So I don't think we've quite come to grips with the rat race problem that is endemic throughout academia and, in fact, is endemic throughout the society as a whole. I think we need to give some more careful thought to that.

"We have a lot of willing faculty and staff out there who would like to take advice but don't know how to go about it. I, for example, really don't know what are the do's and don't's of making my message in an introductory course on cosmology as attractive as possible to people from different backgrounds. It would be very helpful for me if there could be some agreed-upon techniques for presenting information that could be more effective for people who don't come from my historical social group. What I am saying is, we need some recipes; we need some standard procedures. Perhaps we need our organizations to look at these problems and come up

with standard approaches which are then widely disseminated so that the rest of us can follow.

"And finally, the third thing is, reaching out to male minorities, or another way of putting it is attracting more scientists from low-income groups. I don't know how to deal with that. Most of what we have said deals with the problem of retention once people get to our level of activity. Not much of what we have said deals with bringing them in in the first place and I think that needs a lot more thought.

"The main solution to getting minority students and women more successfully involved in science during that crucial first year was the notion of research as opposed to the classroom. Student after student said that actually doing science, as opposed to dry classroom study, was the key that drew them in and kept them there."

James Merz

"My bottom line is that science *is* more demanding than many other (though certainly not all) activities, but that artificial impediments imposed by the specifics of one's personhood need to be eliminated.

"I was extremely moved by some of the things I heard at the conference, when I realized the extent to which very highly motivated and intelligent young people, obviously as committed as anyone to the attainment of excellence, were distracted or prevented from giving it their best effort as a result of their gender, color, or background."

Charles Shank

"Institutions cannot appear to give advantages to only one group. They will deny their access to the full range of human talent and simply not be as great as they might.

"The composition of the work force will ultimately change how we do our work. The inclusion of more women in the work place has increased the demands for childcare and other family assistance. . . . Unfortunately the resources they require are hard to come by. But if we are committed to the goal of utilizing effectively every member of our institutions then we will find cooperative ways to create the needed assistance.

"I have heard you say that change must come from the top—that 'top down' support is essential. I agree, but that is only the beginning. Everyone must be involved, and must feel empowered. Even if the person in charge is not supportive, that shouldn't stop you. The issues raised here are too important to be left only in the hands of the person at the top of an organization. For a person in charge to make something happen, everyone must be part of a solution. You must be persistent.

"Excellence is not the issue; the issue is making the opportunity for excellence more available. This should be the goal of our institutions. A person who accepts financial assistance is in no way second-class. Institutions must provide this help, and it should be seen as a positive part of our activities."

Richard Tapia

"This conference has made me realize that we are failing to sell science to all of America's youth. We have not taken the time to study their value system and continue to sell in an outdated manner which promotes only one side of science.

"Listen to graduate students. They have a lot to say. I was very impressed with all the things the graduate students said. I have a tendency not to listen to my own.

"There is a need to reevaluate outdated criteria in the light of the new culture and new attitudes: criteria as they relate to admissions, hiring, promotions, and tenure.

"We need to stress that a good scientist can be a good family member. I think that many of us have hidden this. Maybe we haven't sacrificed at the level that many people think we have.

"I think another point is the importance of accepting students with the expectation of completion and nurturing them toward that goal. That is one thing that we do at Rice; our expectations are that everybody that we accept should be able to get through the program and we try to nurture toward that goal.

"The last point is the incredible power present when a group of women or minority graduate students speak about how they feel to majority faculty. To hear the four people speak was extremely powerful."

Rose Sergeant

"My commitment is that I will continue to hone my listening skills. You think you're listening but there are all these other pressures. . . . So I pledge to continue to hone my listening skills to hear the communications of the community and then work to translate those communications into building more bridges—bridges to widen our definition of the scientific community to include those people who would like to learn about science without making it their career.

"You helped me discover what new models of leadership and new models of success might be. And finally, because I too pursue my vocation with passion and tend to be intense, I promise to have fun."

Fiona Goodchild

"Every graduate student has the right to find out more about this culture when they come into it. They will be able to do this if they can exchange information and talk to people. You also have a right to expect to change that culture. I heard a lot of you say that you had ideas for doing that and I'd like to propose that you get onto a bulletin board and tell each other about those ideas, and the success you're having with these things at your home institutions.

"I'd like to suggest that the language of science is another issue. We heard one or two suggestions here that you don't like some of the existing terminology that's used in science. It's restrictive; it's militaristic; it's rigid, sometimes in a way that is unnecessary; it really doesn't reflect what's going on. I think that this kind of interchange could provide a way of adopting new terms which will be useful when we go back to our home institutions and start talking to people about what this conference was about."

Strategies for Maintaining a Network

Forming a relationship is not adopting a resolution, where we can draft appropriate language, vote on it, and then all but forget it. A relationship is more like a garden: it is constantly changing. It needs regular attention or it will go to seed. Demonstrating acceptance of the other is both an initial act and a continuing requirement. Each time an incident in a relationship comes up, it provides an occasion for either judging and rejecting others or for demonstrating our interest in them as people who count.

Getting Together, p.169

All conference participants and especially the members of the Integration Team recognized that the enthusiasm that had been captured at this meeting was infectious. Many scientists had gained new insight into the experiences of colleagues and students. Despite differences in perspective there was substantial agreement about the strategies outlined in this report. Of course, there was also recognition that many of them imply more work for people who already seem to grapple with too many demands on their time. But there was evident energy for trying to make a difference once back at our home institutions.

How can you pursue the next stage of the experiment?

Make a point of reporting your attendance at or interest in this conference to your colleagues and leading administrators on your campus.

Discuss the strategies in this handbook with colleagues and administrators.

Encourage your peers and colleagues to assess the working climate in your center or department.

Find out about other initiatives for underrepresented groups that are organized at your campus. Consider whether it would be valuable to be involved in them.

Keep in touch. Join and subscribe to the e-mail bulletin board which serves as a network for conference participants. Contact **Culture@cs.rice.edu** for details.

Appendix I

Guiding Principles of an Inclusive Community

- Dispense with the hierarchy
- Encourage communication
- Offer equal involvement to all members of the group in decision making
- Foster interconnectedness among the groups
- Replace competition with collaboration
- Avoid adversarial framing of the issues

Appendix II

In Balance

GUIDING PRINCIPLES

1. Listening is a primary component of communication.

2. Although an individual's opinions, points of view and feelings may not hold equal value for everyone, there should always be equal respect for the individual expressing them.

3. Those attending a meeting are not required to speak, however your presence constitutes an agreement to support the meeting, even though you may not agree with the focus of discussion at a particular time.

4. If you have a complaint, voice it directly to someone whom you consider can do something about it. It is important to examine the intention behind your criticism and to communicate it in a way which will support the goals of the conference.

5. Contrary to traditional educational values and training, competition to be the best has no value at this meeting.

6. Challenging the status quo involves taking risks. There will be times when people may feel uncomfortable, awkward or emotional. If this happens to you or to others, please remember that a little courtesy and compassion go a long way.

Appendix III

The Changing Culture in Science
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